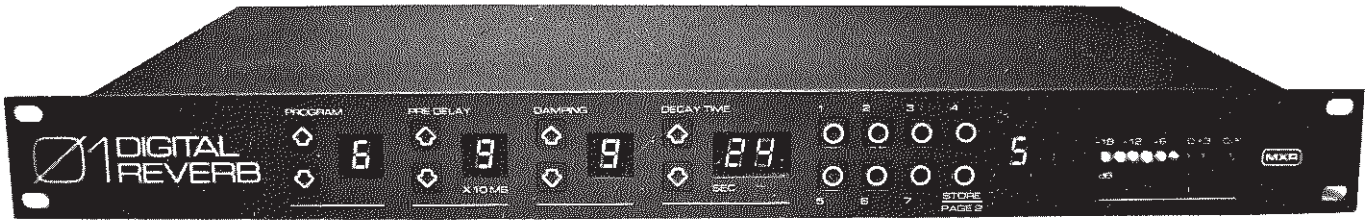
# Ø1 DIGITAL REVERB




**Owner's Manual**

The Zero-One is a complex user controlled device. While able to generate excellent analogs of natural reverberation, the Zero-One's capabilities offer the user an extreme range of effects. The reading and understanding of this manual is advised for proper operation.

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## INTRODUCTION

The technology of digital reverberation has been steadily developing since its infancy in the early 60's. The Zero-One is the result of work done by researchers over this time, and in many respects is the most advanced design to date. Front panel controls offer the user access to important reverb variables simply and quickly, in an easily understood format. The programs available are selections of reverberation types most frequently used in the studio, such as plates, chambers and halls.

Decay times may be set over a wide range to produce expansive choral effects at high settings or to simulate small rooms, ideal for adding thickness and body to drum tracks.

The Zero-One may also be used live with remote controls to achieve sustain pedal and infinite decay time effects, as well as dynamic reverb — a quite unnatural but useful program modification.

Program and option descriptions given in this manual are meant to be helpful in selecting appropriate settings, but there is no substitute for hands-on experience. The user is encouraged to experiment with the programs, discovering the possibilities within. The section on programs in this manual will provide a good starting point for your acoustic journey.

The Zero-One is an outboard device intended to be used with a mixing console equipped with reverb send and receive controls. The maximum input and output levels are +6 dBV, therefore the mixer used should be capable of handling these levels without distortion.

**Input:**

The input of the Zero-One is mono, active balanced, with a 20K ohm input impedance. In connecting consoles with stereo sends, connect one send output or mix the sends to mono before connecting to the reverb.

When connecting to a board with single ended outputs, the (-) input (ring on the phone plug connection) should be connected along with the reverb input ground to the ground of the console send, through separate wires. This allows the balanced input to be fully realized. Special attention should be paid to this input in that at long decay time settings, the Zero-One has enormous gain at specific frequencies, and small amounts of noise and crosstalk at the input will result in exaggerated output noise levels. In less critical installations, a mono patch cord will suffice.

**Outputs:**

The Zero-One outputs are capable of driving full output levels into 600 ohm line impedances. The outputs are single ended, with a source impedance of 100 ohms. Shorting the outputs to obtain a mono output is not recommended. In such applications a 1K resistor in series with each output to a common point is advised. In applications requiring a mono output, such connection is desirable, in that higher echo density is achieved.

**Thermal:**

The Zero-One will normally run warm to the touch, and in some applications may require special consideration. If the desired installation is above a power amplifier for example, simply allowing an inch or so of space above or below the unit when mounting in a rack should supply sufficient convection cooling.

## FRONT PANEL CONTROLS

Each of the controls on the Zero-One front panel consists of a display to indicate the current parameter's value and two pushbuttons to modify that value. Holding a button down will increment or decrement the display automatically. Momentarily pressing a button will change the display by individual increments.

**Decay Time:**

Natural reverberation results from sound reflecting off the walls of a confined space. The character of the reverberant sound is dependent on the size and shape of the space, the materials used in construction, and any objects within the space that tend to absorb the sound energy.

The time required for the reverberant energy to decay to one-millionth its original level is called the decay time, and is indicated on the front panel of the Zero-One as such. The maximum and minimum decay times are a function of the program currently selected and for convenience change in discrete jumps. At short decay times, the parameter can be set in 0.1 second intervals, where in the range of 5 to 10 seconds, 0.5 second steps are adequate.

Although the Zero-One has the capability of generating extremely long decay times, these are very unnatural and should be avoided on complex running material. Version 1.1 has a feature we call dynamic reverberation that overcomes some of these problems by automatically changing decay time in accordance with input signal level. Consult the Programs section, programs 7, 8, 9 for details.

**Damping:**

As sound travels through air, or reflects off a soft surface, the high frequencies are absorbed quicker than the balance of the sound. In the Zero-One we call this damping, and express it in arbitrary units from 0 to 9. Damping can make a very noticeable difference in the sound of a given program, ranging from the sound of a room with stainless steel walls (0) to one with tapestries and carpets draped about (9). Excessive damping applied to long reverb times will sound strange in that this combination does not occur in nature, but may prove useful in the studio.

**Pre-Delay:**

In recording practice, a delay is often inserted between the console and the reverb chamber. This pre-delay serves two functions — to add an apparent depth to the reverb sound; and to separate, in time, the original sound from the very dense reverberation. This second effect leaves the original sound uncluttered and more distinct, as it stands alone for the duration of the pre-delay.

Pre-delay on the Zero-One is set in 10 millisecond increments from 0 to 90 milliseconds total, indicated by the numbers 0 through 9.

In version 1.1, the Pre-delay control doubles as the reverb Mix control, where the numbers 0-9 represent in arbitrary units the amount of reverb that is mixed into the initial sound of a given program. Access to this parameter is gained by pressing the Store/Page 2 button. Releasing the button returns the controls and display to the pre-delay function.

**Program:**

The Zero-One with rev. level 1.1 is equipped with 6 basic reverberation programs, numbered 1 through 6. Programs 7, 8, and 9 are similar to 4, 5, and 6 respectively, with the exception that they are dynamic. Refer to the section on program descriptions for details.

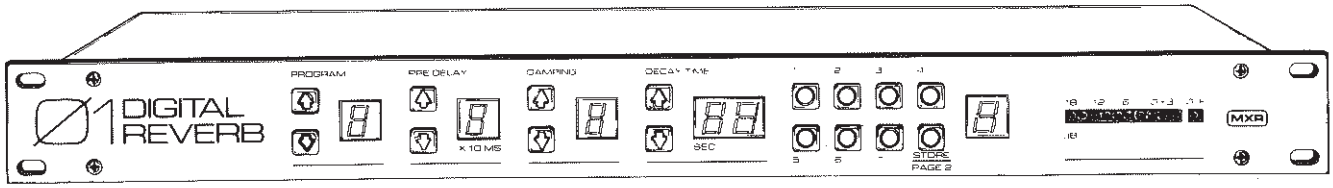
The programs set the size and shape of the physical structure the reverb will simulate. They have been chosen to satisfy the current needs of music production and each has qualities best suited to a particular type of program material. In general, the size of the structure increases with increasing program number, 1 being plate-like and 6 being like a large hall. Small structures suffer from frequency response aberrations, called coloration, typical of a shower stall or a trash can; certainly not to be used with very long decay times. On the other hand, such small spaces are exceptional for delivering a smooth result on highly percussive sounds like drums. Larger rooms tend to sound rough on such impulsive material, but treat sustained tones and smooth music beautifully, and are the programs of choice where long decay times are required.

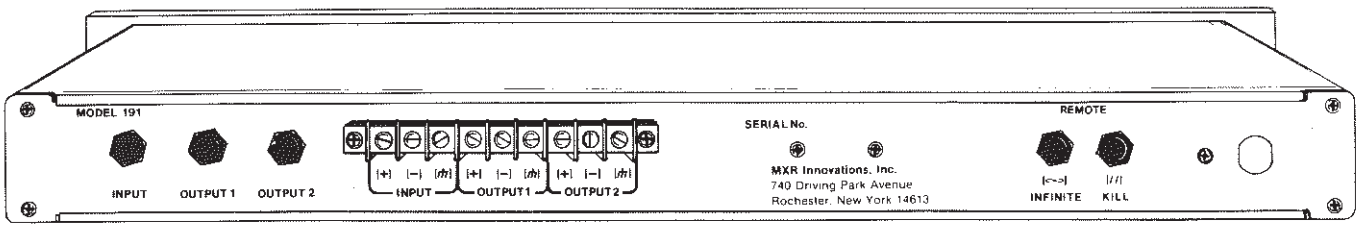
**Presets:**

The Zero-One allows for 7 presets of front panel control settings. Pressing a preset button recalls that preset number to the front panel displays. Holding the store button while pressing a preset button stores the current displayed parameters into that preset.

**Level Display:**

The input level is indicated on the front panel as a bar-graph display. The Level meter is calibrated in 3dB steps. The Overflow indicator will come on if the numerical values in the processor exceed the processor's usable range. The use of long decay times with small-structure programs or operation with high reverb mix levels will likely result in this condition before maximum input level is achieved.



## PROGRAMS

Description of program sounds is obviously quite subjective. Where a program may be described as a plate, it is so described because of the similarities between the resulting reverberation of the program and an actual plate. Plates, rooms and digital reverberators are all very different in their means of generating reverberation. The computational power required for exact simulation of a plate is far beyond the available technology of this decade, and quite possibly, this century. When a program is described, as a plate for example, do not expect it to sound exactly like a plate, no matter how the plate is tensioned or positioned. Rather, consider the useful qualities of the plate in terms of transient and frequency response, and how these properties lend added dimension to music production.

The propagation of sound within the confines of a three dimensional space, or across the two dimensional surface of a metal sheet is subject to boundaries where the sound is reflected. In the case of a plate the sound essentially bounces off the edges and back across the plate. In either case, an impulse will spread omnidirectionally through the medium, reflecting off boundaries like ripples in a pool. Irregularities in a boundary cause diffusion of the reflected sound impulse, where in the case of a highly irregular boundary, a single impulse will be reflected as several impulses. In such a case, the complexity of the sound in the medium builds quickly with each reflection and is said to have a high echo density. Rooms with flat parallel walls provide less of a chance for building echo density, and are considered to generally have a hard, repetitive sound.

The dimensions of the medium also play an important role in the development of echo density. As a structure is made larger, the time required for the sound to travel to the next boundary increases, increasing the time required to build echo density to high levels, a characteristic of large halls.

Diffusion of the original impulse quickly into a multitude of reflected echoes is the objective of small structure programs. This is largely due to the short transit time of an impulse between diffusing boundaries. Small structures however, are associated with quite predominant resonances, like shower stalls and trash cans. These resonances can become annoying especially when used at long decay times. The selection of a reverberant structure is often a trade between transient response and high diffusion on one hand, and flatness of frequency response or lack of coloration on the other.

Another characteristic of the individual programs, somewhat independent of the previous discussion, is that of initial response. When a sound impulse originates within a space, it travels at its propagation rate to the listener. Shortly thereafter, the listener hears a reflection off the floor, ceiling and walls. These early echoes are well defined and provide the listener with a sense of the basic dimensions of the space. Each program in the Zero-One has a unique set of early responses, that add to the dimension and realism in the reverberation result.

**Program 1:**

Extremely diffuse, immediate response. Excellent for general percussion and short decay time effects. Minimum reverb time is 0.1 seconds, which is usable in special applications. Maximum decay time is 15 seconds and is made available for special effects only. Good results can be had with 40 ms pre-delay, damping = 5 and a decay time between 0.3 and 1.2 seconds.

**Program 2:**

Similar to #1 but more open. Good plate for drums in general due to a relatively diffuse impulse response and a warmer bottom end. Decay time minumum = 0.1 seconds, where some interesting snare sounds can be had with gated returns. Still slightly colored at long decay times, and therefore not always best for vocals. Try: 0-30 ms pre-delay, damping = 3, decay time = 0.8 seconds.

**Program 3:**

Small chamber. Designed around smooth, non-parallel walls with little architectural detail. Good impulse response and moderately flat as well. Very nice with vocals, and tolerant of longer decay times. Fat drum sounds can be had at short decay times, however extremely sharp percussion can get grainy. Decay times around 1.2 seconds work nicely.

**Program 4:**

Larger, more irregular chamber than #3. Can be extended to quite unnatural decay times successfully, while still offering diffuse transient response with most percussion. Good lead vocal choice. Try: 0-90 ms pre-delay, damping 4-8, decay time 1.5-4.0 seconds.

**Program 5:**

Good sized, empty hall. Parallel walls with some detail. Beautiful on sustained sounds, especially strings and flute. Very useful for effects, especially sustain pedal service. Quite flat frequency response, but somewhat grainy on percussion, especially with very short decay times. The pre-delay and decay times can get pushed up on this program to cause some very impressive effects.

**Program 6:**

This is an example of a very large structure. It is not meant for drums, although it turns muted toms into thunder readily. An extended initial response gives its sheer size away instantly, and should be used with dimension in mind. Can be used much the same as #5, but caution should be exercised with the reverb time control, as too much of a good thing often spoils the musical soup. When tempted to push the reverb time up, consider the dynamic programs 7, 8 and 9.

**Programs 7, 8 and 9: Dynamic Reverberation**

Dynamic reverberation is an example of the Zero-One's unusual capability and is demonstrated in version 1.1. Programs 7, 8 and 9 are similar to 4, 5 and 6, with the exception that the decay time is automatically varied depending on input level. At low input levels (less than -15 dB) the decay time is the selected value displayed. At high input levels, the decay time is automatically lowered to the minimum decay time, set by the user while the Store/Page 2 button is depressed.

The transition between maximum and minimum decay time is smooth and gradual, although the display will only read the minimum decay time with an input signal long enough in duration to allow the transition to be complete (approx. 100 ms.). This process is similar in result to compressing the returns, with an important distinction; every new input to the reverberator tends to replace what was there previously. It sounds very impressive on voice, where the running reverberant sound is relatively clear of clutter, and the stopped reverberation can be extended to the full 24 seconds.

An extraordinary effect can be generated in this way for almost all solo program sources. If extreme decay times are selected, the external Stop switch can be helpful in discontinuing the last portion of the reverberant tail. Often, with high return levels, some pumping can be noticed. This is often a result of too high a return level, or too great a range of decay times that the Zero-One is being asked to cover. Although extreme settings are often tempting, they should be dealt with cautiously.

## EXTERNAL CONTROLS

The Zero-One is equipped with two rear panel jacks marked Hold and Stop. These are external controls meant to be connected to momentary, normally open switches, available as accessories. Pressing the Hold switch causes the reverb to extend its current decay time to infinity, and to return to the selected decay time upon release of the switch. This feature is wonderful for keyboard players, as it simulates the sustain pedal on a piano, and is usable with synthesizers. Depressing Hold for extended periods of time is not recommended, as input program material is still being conducted to the reverberator, a gradual build up of noise and program are likely to overflow the processor, resulting in distortion.

Stop has the opposite function. When depressed, Stop will reduce the decay time to the minimum allowable for the selected program. Using a normally closed switch with Stop will be similar to the previsous example of hold, with the exception that the maximum decay time is settable on the front panel. Stop is also useful with extreme settings of decay time in that the excessive reverberatnt energy can be stopped at will, smoothly and quickly.

## FACTORY PRESETS

Version 1.1 contains factory presets that are not user alterable. These presets can be installed into the user alterable preset memory while destroying previously contained preset data. Recalling the factory presets is accomplished by pressing the preset 4 button, the decay time increase button and the program # increase button simultaneously.

## SPECIFICATIONS:

| | |
|---|---|
| **CONNECTIONS:** | ¼″ RTS phone jacks (balanced)<br>9 terminal barrier strip |
| **PRESET STORAGE:** | 7 user settable presets |
| **REVERB TIME:** | 0.1 sec. to 24 sec. |
| **FREQUENCY RESPONSE:** | 150 Hz - 10 kHz |
| **DYNAMIC RANGE:** | 75dB (typical) |
| **INPUT:** | Mono, 20k balanced bridging<br>+6dB max. |
| **OUTPUT:** | Stereo, 100 ohms +6dB max. |
| **POWER:** | 115V, 25W (US & Canada)<br>230V, 25W (Europe) |
| **DIMENSIONS:** | 1.75″ high EIA rack, 9″ deep |
| **PROTECTION:** | Mains transformer internally<br>thermal limited |

## NOTES

**MXR Innovations, Inc.**, 740 Driving Park Avenue, Rochester, New York 14613 (716) 254-2910

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